Dynamic Pricing Model for Exploring Resource Rental Planning in Cloud Computing

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Abstract : The promising feature of cloud computing model that has abundant resources and elasticity, liberate organizations from the costly infrastructure investment. The main issues arise when the applications generate high volume of data that acquire significant cost on storage and transfer. Hence, the need arises for the service providers to evaluate resource rental options that must be displayed for the consumers. The main objective is to serve both the clients and the service providers. The profitable valuation model is used in order to reduce the pricing of cloud resources. In this model, clients pay for the storage space in which they could post images for the advertisements. Cloud Service Providers reduce the price for storage based on several characteristics such as on advertisement clicks by the users. Clients make profit by the number of advertisement clicks by the users. This model ensures that the profit increases due to the increase in number of clients.

IndexTerms **– Service Provider,Resource allocation,dynamic pricing model,**

I. INTRODUCTION

A pool of virtualized, managed computing power, storage, platforms and services are delivered to the customers by the providers on demand over the internet[1]. Recently cloud computing technologies are increasing popular and therefore the dependence on power also has a tremendous increase. According to the survey presented in [2], it is predicted that the data centers located at the provider's place consumes 0.5 percent of the world's total electricity usage and if this continues, it is assumed to be in quadruples by the end of 2020. The cloud computing industry has increased much popularity in all business but in the retailing industry is still sluggish in adopting cloud computing technology. Implementing the cloud in retailing industry provides several benefits such as the scalability, less time, flexibility and reduced costs. As per the survey done by Microsoft, about 3000 business decision makers across the US, nearly half of the retailers have already adopted cloud computing. As per Gong [3] suggestions, organizations might adopt five simple guidelines to adopt cloud computing in order to stay firm.

1. A selection list of resources could be decided by the organization to move onto the cloud.
2. Service costing of the organization could be made as core competency.
3. IT must be designed as a supply chain.
4. Security could be provided as a service.
5. An exit strategy must be started.

In addition, Mankotia's [4] recommendations for organizations to get into the cloud are as follows.

1. A proper complete business case must be selected first.
2. Cloud computing service crashing must be planned properly.
3. Proper attention and focus must be on understanding the SLA of providers.
4. Regular monitoring of users and their usage must be done.
5. Location of data must be identified.

II. RELATED WORKS

As per the research report generated by Accenture, the competition with online pure-play retailers such as Ocado, eBay, Kiddicare[5,6] and as well as the customer demand prompts for the fast adoption rates for cloud in global retail sector. The industry's cloud market is expected to show an increase in revenue and it will be tripled from $4.2 billion in 2011 to more than $15.1 billion in 2020. Clients might be attracted by providing various incentives, preferably with a cheaper price. In late 2009, Amazon was the first cloud provider who tried in issuing a facility like giving incentives by declaring its spot instances pricing system. "Spot Instances allow customers to bid on unused Amazon EC2 capacity and run those instances for as long as their bid exceeds the current Spot Price. The Spot Price changes periodically based on supply and demand, and customers whose bids exceeds it gain access to the available Spot Instances" [Amazon 2009][7].

Conventional computing approaches make the retailers maintain the information of customers, reviews and their feedbacks for smooth relationship with them. Retailers face the difficulties since the investment in purchasing the software applications, hardware infrastructure including servers and storage devices etc could be high[8]. Moreover, the cost also involves in hiring the people to main both the hardware and software infrastructure. But in cloud computing, the centralized facilities of hardware, software that are identified on several servers in large data centers make the retailers free from pestering. In [9], the author discovered that cloud

computing as an efficient approach since it acts as a hub for huge volumes of sales data that could be stored for further analysis and also in real time inventory management.

Among the retailing industry, the data that has been generated with the help of Point of Sale systems is huge. Retailers those who are small and medium in size face the difficulty during the maintenance of the data since the data generation will be in huge and the resources might not be enough to handle. Hence they depend on the retail cloud provider who is able to provide the storage service. In addition, data collection from additional servers that are connected to the supply chain and in turn to the independent cash points at small stores is done. The data thus collected is stored it in the retailer's location for further process. The retailer in turn will be able to access the data from anywhere and at anytime. As a result, the major issue of the service provider is the minimization of resource rental cost during the application service demand period. An optimal resource provisioning scheme has to be developed in such a way that the security requirements are met and the penalty due to under-provisioning, extra cost due to over-provisioning. Many research works have been driven into this field.

Effective resource provisioning controls has been executed by varying certain factors such as workload are considered as coarse-grained with respect to the application elasticity exploration in connection with varying resource pricing options. The operational cost of Application Service Provider has to be reduced by an effective resource plan. This could be made possible by controlling the rental activities of the resources on a time-slot period basis, charging on hourly basis for various types of resources so that the estimated service demand has to be met and the resource rental cost has to be minimized. Many researchers [10-12] has done various studies on the approaches that are been implemented in reducing the operational cost and the revenue maximization from the service provider's perception. Novel trading approaches must be developed as the computational resources are open for various deal in the cloud market as per the works found in [14-16].Amazon EC2 is considered as a very good example that drew attentions by various researchers. Several suggestions like allocation of resources through the brokerage services [17], the instances that have been reserved could be given at very low price in order to reduce the cost have been promoted in [18-19]. With the help of statistical analysis, resource availability could be guaranteed in the spot instance market [14-16].

A comprehensive analysis of spot instances based on one year price history in EC2 has been done and thus this leads to the recommendation of the statistical model so that the price variation in hour-in-day and day-of-week seemed to be dynamic in nature as per the report from Javadi et al [19].

Apart from the optimal planning, another issue that has to be addressed is the uncertainty of computational resource pricing. This is considered as the challenge that has to be resolved in the spot resource market that has been emerged in the recent years. The unit price of a computational instance is found to be unstable since it depends on the resource supply and demand level. An auction approach was employed by the Amazon so that the price of the instance was determined. Due to the influence on idle cycles by the introduction of spot instances from the regular on-demand server pool, these instances are called off for auction at a less price than that of the regular on-demand instances[6-7]. Hence, the real time bidding market draws the attention of many service providers in order to increase the capacity if the server at a very low cost. In this work, an analysis on optimal resource rental planning strategies for fixed pricing and stochastic pricing resource markets have been analyzed.

III. FIXED PRICING

Demand schedule of the resources have to be forecasted based on the periodic review of the running progress of the services that have been deployed and thus the cost optimization during the job allocation is done optimally in such a way that it is not wasted on extra computation, data transfer or storage. This model is mainly useful in the implementation of high-cost Virtual Machine classes. This happens mainly due to the eradication of unwanted jobs that are executed by reducing the VM rental frequency[11-13]. This model is based on the dynamic lot-sizing that has been met in the production planning phase. To necessitate the attainment and allocation of storage and computational resources to the corresponding applications in order to assure and satisfy the demand over a particular and fixed time horizon. Optimization of rental decision on a time slotted basis has been done by fixing the price of the resource. The system model for the fixed pricing model is shown in the below figure 1.

Computation tasks and data storage could be completely outsourced to Infrastructure-as-a Service (IaaS) provider(s) who maintains a shared resource pool as shown in fig 1. Typically the usage of resources leads to the financial gain for the Application service providers. In addition, the charges are applicable for the rental activities until the completion of the service. The total cost could be calculated as

Total cost = Network transfer-in cost + $\sum_{i=0}^{n} vm\ i$ ----------→ Eqn 1

The total cost that is been incurred depends on two factors such as the duration of the rent and the unit price of the virtual machine instance. The storage and the network-transfer-in and network-transfer-out cost depend on the data size. To facilitate the resource auto-scaling for the purpose of efficient resource utilization, the client workload pattern has to be recognized and a forecast demand schedule for each virtual machine has to be built. Once this process gets completed and then the service provider could plan about the schedule of resource renting process with the help of removal of job, replication of job, migration and addition.

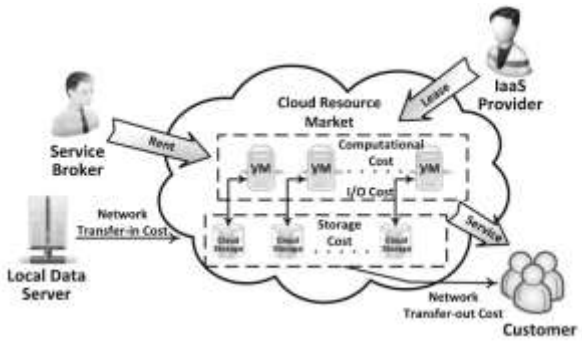

Fig 1 : System model for the resource rental planning process.

IV. DYNAMIC PRICING MODEL

The objective of this model is to identify a method that could generate the maximum anticipated revenue within the fixed time 'T'. In order to generate more revenue, this model facilitated to sell goods or services online by adjusting the selling price based on the fly in response to the dynamic market demand. The method fix the price for each items based on the sales of those items. The price generated from the architecture brings profit to the provider while at the same time competitive for the clients. The main benefits of this dynamic pricing model are

- Memory allocation will be calculated and provided properly in bytes
- Pricing will be reduced accordingly when comparing with plan that has been selected and proper usage of the storage space

When the demand for the corresponding product is high, the cost will be fixed high. Hence the customers have to pay much to buy the product. For example, prices and production scheduling for a single product over a finite horizon. Let α be the demand, β be the price that has been fixed, t be the period and I be the end of period inventory. Base on the demand α, β increases.

α is inversely proportional to β.

S.No	Demands	Prices	Revenue
1	45	90	4050
2	39	83	3237
3	36	76	2736
4	27	71	1917
5	24	66	1584
6	15	62	930
7	10	58	580
8	4	55	220
9	2	52	104
10	1	50	50

Table 1 : dynamic pricing

Total demand ($\sum\alpha_i$): 203

Revenue ($\sum Ri$): 4009

Therefore for a period R_i * α_i has to be calculated and therefore revenue thus generated is 15408.

The proposed pricing model depends on the need of the customer and the customer has the liberty to choose among the various plans and as well as shifting from one plan to another plan is made possible. The architecture of the proposed model is shown in the below fig 2.

Fig 2 Architecture of the pricing model

There are three main modules in this architecture, they are

i. Admin Module
ii. Customer Module
iii. Pricing Module

4.1Admin module

- Admin has the responsibility of adding new customers, edit the customer details, view/ delete customer details
- Admin has the responsibility of maintaining the entire database
- Admin can change the pricing plan

4.2 Customer Module

- New Customers have to register their details such as name, email id, phone number, address and password
- Customer chooses the suitable pricing plan Customer then posts the product
- The posted products are displayed in the website

4.3 Pricing Module

- Pricing module consists of price for the cloud storage
- Customers have to choose their suitable pricing plan
- Customers pay for the cloud storage every month
- Customers can change the pricing plan based on their needs

The plan could be chosen based on the customer needs as shown in the figure 3 so that the customers could be benefitted much.

Figure 3. Plan selection

CONCLUSION

The cloud approach for implementing a retail management system adopted in this project offers massive benefits to retail organizations in managing retail operations. It will help the retail organization to overcome the high costs of running and maintaining technology infrastructure in-house. Cloud computing will allow the retail organization to focus more attention on core activities of efficiency of workflow and business operations rather that maintaining servers or systems. In future work, the evolution of SMP on a database with incremental updates and attributes with partially-ordered domains could be planned.

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